

SEQUENCE LISTING

  
<110> Weigel, Paul H.  
DeAngelis, Paul  
Kumari, Kshama

  
<120> Hyaluronan Synthase Gene and Uses Thereof

<130> 3554.011

<140> US 09/469,200  
<141> 1999-12-21

<150> US 09/178,851  
<151> 1998-10-26

<150> US 60/064,435  
<151> 1997-10-31

<160> 10

<170> PatentIn version 3.1

<210> 1  
<211> 1254  
<212> DNA  
<213> Streptococcus equisimilis

<400> 1  
atgagaacat taaaaaacct cataactgtt gtggcctta gtatttttg ggtactgtt 60

attacgtca atgttatct ctttggct aaggaagct tgcattttt tggcttttg 120

ctgatagctt acctatttagt caaatgtcc ttatcctttt ttacaagcc attaaaggga 180

agggctggc aatataaggt tgcagccatt attcccttta ataacgaaga tgctgagtca 240

ttgctagaga cctaaaaaag tggcagcag caaacatc ccctagcaga aatttatgtt 300

gttgcgtatg gaagtgtca tgagacaggt attaagcgca ttgaagacta tggcggtac 360

actggtgacc tatcaagcaa tgcattgtt catcggtcag agaaaaatca agggaaagcgt 420

catgcacagg cctgggcctt taaaagatca gacgctgtatg tcttttgac cggtgcacca 480

gatacttata tctaccctga tgcatttagag gagttgttaa aaacctttaa tgacccaaact 540

gttttgctg cgacgggtca ccttaatgtc agaaatagac aaaccaatct cttacacgc 600

ttgacagata ttgcgtatga taatgtttt ggcgttgaac gagctgccca atccgttaca 660

ggtaatatcc ttgttgctc aggtcccgctt agcggttaca gacgcgaggt ggttgtcc 720

## Sequence Listing created in PatentIn.ST25

aacatagata gatacatcaa ccagaccc tc ctgggtattc ctgttaagtat tgggtatgac	780
aggtgcttga ccaactatgc aactgattt a g g g a a a g a c t g t t t a t c a a t c a c a t g c t a a a	840
tgttattacag atgttccctga caagatgtct acttacttga agcagcaaaa ccgctggaac	900
aagtccctct ttagagagtc cattatttctt g t t a a g a a a a a t c a t g a a c a a a t c c t t t g t a	960
g c c c t a t g g a c c a t a c t g a g g t g t c t a t g t t a t g a t g c t t g t t a t t c t g t g g t g g a t	1020
t t c t t t g t a g g c a a t g t c a g a g a t t g a t g g c t a g g g t t t a g c c t t t c t g g t g a t t	1080
a t c t t c a t t g t t g c c c t g t g t c g g a a c a t t c a t a c t g c t t a a g c a c c c g c t g c c t t c	1140
t t g t t a t c t c c g t t t a t g g g g t g c t g c a t t g t t t g t c c a t a g c c c t t g a a t t a t a t	1200
t c t c t t t t a c t a t g a a a a t g c t g a c t g g g g a a c a c g t a a a a a t t a t t a a a	1254

<210> 2  
<211> 417  
<212> PRT  
<213> **Streptococcus Equisimilis**

**<400> 2**  
**Met Arg Thr Leu Lys Asn Leu Ile Thr Val Val Ala Phe Ser Ile Phe**

Trp Val Leu Leu Ile Tyr Val Asn Val Tyr Leu Phe Gly Ala Lys Gly  
20 25 30

**Ser Leu Ser Ile Tyr Gly Phe Leu Leu Ile Ala Tyr Leu Leu Val Lys**  
35 40 45

Met Ser Leu Ser Phe Phe Tyr Lys Pro Phe Lys Gly Arg Ala Gly Gln  
50 55 60

Tyr Lys Val Ala Ala Ile Ile Pro Ser Tyr Asn Glu Asp Ala Glu Ser  
65 70 75 80

Leu Leu Glu Thr Leu Lys Ser Val Gln Gln Gln Thr Tyr Pro Leu Ala  
85 90 95

**Glu Ile Tyr Val Val Asp Asp Gly Ser Ala Asp Glu Thr Gly Ile Lys**

Sequence Listing created in PatentIn.ST25  
100 105 110

Arg Ile Glu Asp Tyr Val Arg Asp Thr Gly Asp Leu Ser Ser Asn Val  
115 120 125

Ile Val His Arg Ser Glu Lys Asn Gln Gly Lys Arg His Ala Gln Ala  
130 135 140

Trp Ala Phe Glu Arg Ser Asp Ala Asp Val Phe Leu Thr Val Asp Ser  
145 150 155 160

Asp Thr Tyr Ile Tyr Pro Asp Ala Leu Glu Glu Leu Leu Lys Thr Phe  
165 170 175

Asn Asp Pro Thr Val Phe Ala Ala Thr Gly His Leu Asn Val Arg Asn  
180 185 190

Arg Gln Thr Asn Leu Leu Thr Arg Leu Thr Asp Ile Arg Tyr Asp Asn  
195 200 205

Ala Phe Gly Val Glu Arg Ala Ala Gln Ser Val Thr Gly Asn Ile Leu  
210 215 220

Val Cys Ser Gly Pro Leu Ser Val Tyr Arg Arg Glu Val Val Val Pro  
225 230 235 240

Asn Ile Asp Arg Tyr Ile Asn Gln Thr Phe Leu Gly Ile Pro Val Ser  
245 250 255

Ile Gly Asp Asp Arg Cys Leu Thr Asn Tyr Ala Thr Asp Leu Gly Lys  
260 265 270

Thr Val Tyr Gln Ser Thr Ala Lys Cys Ile Thr Asp Val Pro Asp Lys  
275 280 285

Met Ser Thr Tyr Leu Lys Gln Gln Asn Arg Trp Asn Lys Ser Phe Phe  
290 295 300

Arg Glu Ser Ile Ile Ser Val Lys Lys Ile Met Asn Asn Pro Phe Val

Sequence Listing created in PatentIn.ST25

305

310

315

320

Ala Leu Trp Thr Ile Leu Glu Val Ser Met Phe Met Met Leu Val Tyr  
325 330 335

Ser Val Val Asp Phe Phe Val Gly Asn Val Arg Glu Phe Asp Trp Leu  
340 345 350

Arg Val Leu Ala Phe Leu Val Ile Ile Phe Ile Val Ala Leu Cys Arg  
355 360 365

Asn Ile His Tyr Met Leu Lys His Pro Leu Ser Phe Leu Leu Ser Pro  
370 375 380

Phe Tyr Gly Val Leu His Leu Phe Val Leu Gln Pro Leu Lys Leu Tyr  
385 390 395 400

Ser Leu Phe Thr Ile Arg Asn Ala Asp Trp Gly Thr Arg Lys Lys Leu  
405 410 415

Leu

<210> 3

<211> 22

<212> DNA

<213> Artificial Sequence

<220>

<223> Primer se1

<400> 3

gctgatgaga caggtattaa gc

22

<210> 4

<211> 20

<212> DNA

<213> Artificial sequence

<220>

<223> Primer se2

<400> 4

Sequence Listing created in PatentIn ST25

atcaaattct ctgacattgc

20

<210> 5

<211> 20

<212> DNA

<213> Artificial sequence

<220>

<223> Primer sesp1

<400> 5

gactcagata cttatatcta

20

<210> 6

<211> 17

<212> DNA

<213> Artificial sequence

<220>

<223> Primer sesp2

<400> 6

ttttacgtg ttccca

17

<210> 7

<211> 1740

<212> DNA

<213> Paramecium bursaria chlorella virus

<400> 7

aagacttctt gaaagttaca atggtaaaaa atataatcat aatggttcg tggcacca 60

tcataacttc aaatctaatac gcgggtggag gagcctctt aatctggct ccggcaatta 120

ctgggtatgt tctacattgg aatattgctc tctcgacaat ctggggagta tcagcttag 180

gtattttcgt ttttgggtt ttccttgcac aagttttatt ttcagaactg aacagggaaac 240

gtcttcgcaa gtggatttct ctcagaccta aggggtggaa tggatgttcgt tggctgtga 300

tcattgtgg atatcgcgag gatccattata tggcccgaaa gtgcctcgag tctgtacgtg 360

actctgatta tggcaacgtt/gcccgctga tttgtgtat tgacgggtat gaggacgtg 420

atatgaggat gggtggcggtt tacaaggcga tctacaatga taatatacg aagcccgagt 480

ttgttctgtg tgagtcagac gacaaggaag gtgaacgcgt cgactctgtat ttctctcgcg 540

acatttgtt ctcctcagctt catcggtggaa aacggggatgt tctttataact gggttcaac 600

Sequence Listing created in PatentIn.ST25

ttgcaaagat ggacccagt gtcaatgctg tcgttctgat tgacagcgat accgttctcg 660  
agaaggatgc tattctggaa gttgtatacc cacttgcatg cgatcccgag atccaaggcg 720  
ttgcaggta ggttaagatt tggAACACAG acactcttt gagtcttcg tcgcttggc 780  
ggtaactttc tgcgtttgt gtggagagga gtgcggcgtc tttttcagg actgttcagt 840  
gcgttggggg gccactgggt gcctacaaga ttgatatcat taaggagatt aaggacccct 900  
ggatttcca ggcgtttctt ggtcagaagt gtacttacgg tgacgaccgc cggctaaacca 960  
acgagatctt gatgcgttgtt aaaaagggtt tggtcactcc atttgctgtt gggtggctg 1020  
acagtcgcac caatgtgtt cggtacatcg ttcagcagac cggctggagt aagtgcgttgt 1080  
gccgcgaaat ttgtacacc ctctcgccg cgtggaaagca cggtttgtct ggaatttggc 1140  
tggccttga atgttgtat caaattacat acttcttcct cgtgatttac ctctttctc 1200  
gcctagccgt tgaggccgac cctcgcccc agacagccac ggtgatttg agcaccacgg 1260  
ttgcattgat taagtgtggg tattttcat tccgagccaa ggatattcg ggcgtttact 1320  
ttgtgttta tacatttgtt tactttctt gtatgattcc ggcaggatt actgcaatga 1380  
tgacgcttg ggacattggc tgggtactc gcgggtggaaa cgagaagcct tccgtggca 1440  
cccggtcgc tctgtggca aagcaataatc tcattgcata tatgtggtg gccgcgggtg 1500  
ttggcgctgg agttacagc atcgccata actggatgtt cgattggaaat tcttttctt 1560  
atcgtttgc ttgggttgtt atttgttctt acattgttttattgttattt gtgttgttgg 1620  
tttatttcac cggcaaaattt acgacttggaa atttcacgaa gcttcagaag gagctaattcg 1680  
aggatgcgt tctgtacgat gcaactacca atgctcagtc tggatgtt ttcctgcaag 1740

<210> 8  
<211> 2937  
<212> DNA  
<213> *Pastuerella Multocida*

<400> 8  
attttttaag gacagaaaat gaatacatta tcacaagcaa taaaagcata taacagcaat 60  
gactatcaat tagcactcaa attatgttga aagtccggcgg aatctatgg acggaaaattt 120  
gttgaatttc aaattaccaa atgcaaaagaa aaactctcag cacatccttc tgtaattca 180

Sequence Listing created in PatentIn.ST25

gcacatctt ctgtaaataa agaagaaaaa gtcattttt gcgatagtcc gtttagatatt 240  
gcaacacaac tgttactttc caacgtaaaa aaatttagtac ttctgactc ggaaaaaaac 300  
acgttaaaaa ataaatggaa attgctcaact gagaagaaat ctgaaaatgc ggaggtaaga 360  
gcggtcgccc ttgtaccaaa agatttccc aaagatctgg ttttagcgcc ttacctgat 420  
catgttaatg atttacatg gtacaaaaag cgaaagaaaa gacttggcat aaaacctgaa 480  
catcaacatg ttggctttc tattatcgat acaacattca atcgaccacg aattttatcg 540  
attacattag cctgttttagt aaacccaaaaa acacattacc cgtttgaagt ttcgtgaca 600  
gatgtatggta gtcaggaaga tctatcaccg atcattcgcc aatatgaaaa taaattggat 660  
attcgctacg tcagacaaaaa agataacggt ttcaagcca gtgcgcctcg gaatatggaa 720  
ttacgcttag caaaatatga ctttattggc ttactcgact gtgatatggc gccaatcca 780  
ttatgggttc attcttatgt tgcagagcta tttagatgtt atgatatac aatcatgggt 840  
ccaagaaaaat acatcgatac acaacatatt gacccaaaag acttcttaaa taacgcgagt 900  
ttgcttgaat cattaccaga agtggaaacc aataatagtgttgcgcctcg agggaaagga 960  
acagttctc tggattggcg cttagaacaa ttggaaaaaa cagaaaaatct ccgccttatcc 1020  
gattcgccctt tccgttttt tgccgggggt aatgttgctt tgcctaaaaa atggcttaat 1080  
aaatccggtt tctttgatga ggaatttaat cactggggtg gagaagatgtt ggaatttggaa 1140  
tatcgcttat tccgttacgg tagtttctttaaaaacttgg atggcattat ggcctaccat 1200  
caagagccac caggtaaaga aatgaaacc gatcgtaag cggaaaaaaa tattacgctc 1260  
gatattatga gagaaaaggc cccttatatc tatagaaaaac ttttaccaat agaagattcg 1320  
cataatcaata gagtacctt agttcaatt tatatcccag cttataactg tgcaaaactat 1380  
attcaacgtt gcgttagatag tgcactgaat cagactgttg ttgatctcgat ggtttgtatt 1440  
tgtaacgatg gttcaacaga taatacccttta gaagtgtatca ataagctta tggtaataat 1500  
cctagggtac gcatcatgtc taaacccaaat ggcggaaatag cctcagcatc aaatgcagcc 1560  
gtttcttttgcgtttaatgggg cagtttagattt cagatgatca tcttgcgtt 1620  
gatgcagttt aactgtgtttt aaaaagata aaacgctacg ttgtgtttat 1680  
accactaata gaaacgtcaa tccggatggt agcttaatcg ctaatggta caattggcca 1740

Sequence Listing created in PatentIn ST25

gaatttcac gagaaaaact cacaacgct atgattgctc accacttag aatgtcacg 1800  
attagagctt ggcatttaac tcatggattc aatgaaaaaa ttgaaaatgc cgttagactat 1860  
gacatgtcc tcaaactcag tgaagttgga aaatttaaac atcttaataa aatctgtat 1920  
aaccgtgtat tacatggtga taacacatca attaagaaac ttggcattca aaagaaaaac 1980  
cattttgtt tagtcaatca gtcattaaat agacaaggca taacttatta taattatgac 2040  
gaatttgatg atttagatga aagttagaaag tatatttca ataaaaccgc tgaatatcaa 2100  
gaagagattg atatctaaa agatattaaa atcatccaga ataaagatgc caaaatcgca 2160  
gtcagtattt ttatcccaa tacattaaac ggcttagtga aaaaactaaa caatattatt 2220  
gaatataata aaaaatattt cgttattgtt ctacatgtt ataagaatca tcttacacca 2280  
gatataaaaa aagaaatact agccttctat cataaacatc aagtgaatat tttactaaat 2340  
aatgatatct catattacac gagtaataga ttaataaaaa ctgaggcgca ttaagtaat 2400  
attaataat taagtcagtt aaatctaaat tgcataaca tcattttga taatcatgac 2460  
agcctattcg ttaaaaatga cagctatgct tatatgaaaa aatatgatgt cggcatgaat 2520  
ttctcagcat taacacatga ttggatcgag aaaaatcaatg cgcatccacc attaaaaag 2580  
ctcattaaaa ctattttaa tgacaatgac ttaaaaagta tgaatgtgaa aggggcatca 2640  
caaggatgt ttatgacgta tgcgttagcg catgagcttc tgacgattat taaagaagtc 2700  
atcacatctt gccagtcaat tgatagtgtc ccagaatata acactgagga tattttgttc 2760  
caatttgcac ttttaatctt agaaaagaaa accggccatg tatttaataa aacatcgacc 2820  
ctgacttata tgccttggga acgaaaatta caatggacaa atgaacaaat tgaagtgca 2880  
aaaagaggag aaaatatacc tgcataacaag ttcatttata atgtataac tctataa 2937

<210> 9  
<211> 972  
<212> PRT  
<213> **Pastuerella Multocida**

<400> 9

Met Asn Thr Leu Ser Gln Ala Ile Lys Ala Tyr Asn Ser Asn Asp Tyr  
1 5 10 15

Sequence Listing created in PatentIn.ST25

Gln Leu Ala Leu Lys Leu Phe Glu Lys Ser Ala Glu Ile Tyr Gly Arg  
20 25 30

Lys Ile Val Glu Phe Gln Ile Thr Lys Cys Lys Glu Lys Leu Ser Ala  
35 40 45

His Pro Ser Val Asn Ser Ala His Leu Ser Val Asn Lys Glu Glu Lys  
50 55 60

Val Asn Val Cys Asp Ser Pro Leu Asp Ile Ala Thr Gln Leu Leu Leu  
65 70 75 80

Ser Asn Val Lys Lys Leu Val Leu Ser Asp Ser Glu Lys Asn Thr Leu  
85 90 95

Lys Asn Lys Trp Lys Leu Leu Thr Glu Lys Lys Ser Glu Asn Ala Glu  
100 105 110

Val Arg Ala Val Ala Leu Val Pro Lys Asp Phe Pro Lys Asp Leu Val  
115 120 125

Leu Ala Pro Leu Pro Asp His Val Asn Asp Phe Thr Trp Tyr Lys Lys  
130 135 140

Arg Lys Lys Arg Leu Gly Ile Lys Pro Glu His Gln His Val Gly Leu  
145 150 155 160

Ser Ile Ile Val Thr Thr Phe Asn Arg Pro Ala Ile Leu Ser Ile Thr  
165 170 175

Leu Ala Cys Leu Val Asn Gln Lys Thr His Tyr Pro Phe Glu Val Ile  
180 185 190

Val Thr Asp Asp Gly Ser Gln Glu Asp Leu Ser Pro Ile Ile Arg Gln  
195 200 205

Tyr Glu Asn Lys Leu Asp Ile Arg Tyr Val Arg Gln Lys Asp Asn Gly  
210 215 220

Sequence Listing created in PatentIn ST25

Phe Gln Ala Ser Ala Ala Arg Asn Met Gly Leu Arg Leu Ala Lys Tyr  
225 230 235 240

Asp Phe Ile Gly Leu Leu Asp Cys Asp Met Ala Pro Asn Pro Leu Trp  
245 250 255

Val His Ser Tyr Val Ala Glu Leu Leu Glu Asp Asp Asp Leu Thr Ile  
260 265 270

Ile Gly Pro Arg Lys Tyr Ile Asp Thr Gln His Ile Asp Pro Lys Asp  
275 280 285

Phe Leu Asn Asn Ala Ser Leu Leu Glu Ser Leu Pro Glu Val Lys Thr  
290 295 300

Asn Asn Ser Val Ala Ala Lys Gly Glu Gly Thr Val Ser Leu Asp Trp  
305 310 315 320

Arg Leu Glu Gln Phe Glu Lys Thr Glu Asn Leu Arg Leu Ser Asp Ser  
325 330 335

Pro Phe Arg Phe Phe Ala Ala Gly Asn Val Ala Phe Ala Lys Lys Trp  
340 345 350

Leu Asn Lys Ser Gly Phe Phe Asp Glu Glu Phe Asn His Trp Gly Gly  
355 360 365

Glu Asp Val Glu Phe Gly Tyr Arg Leu Phe Arg Tyr Gly Ser Phe Phe  
370 375 380

Lys Thr Ile Asp Gly Ile Met Ala Tyr His Gln Glu Pro Pro Gly Lys  
385 390 395 400

Glu Asn Glu Thr Asp Arg Glu Ala Gly Lys Asn Ile Thr Leu Asp Ile  
405 410 415

Met Arg Glu Lys Val Pro Tyr Ile Tyr Arg Lys Leu Leu Pro Ile Glu  
420 425 430

Sequence Listing created in PatentIn.ST25

Asp Ser His Ile Asn Arg Val Pro Leu Val Ser Ile Tyr Ile Pro Ala  
435 440 445

Tyr Asn Cys Ala Asn Tyr Ile Gin Arg Cys Val Asp Ser Ala Leu Asn  
450 455 460

Gln Thr Val Val Asp Leu Glu Val Cys Ile Cys Asn Asp Gly Ser Thr  
465 470 475 480

Asp Asn Thr Leu Glu Val Ile Asn Lys Leu Tyr Gly Asn Asn Pro Arg  
485 490 495

Val Arg Ile Met Ser Lys Pro Asn Gly Gly Ile Ala Ser Ala Ser Asn  
500 505 510

Ala Ala Val Ser Phe Ala Lys Gly Tyr Tyr Ile Gly Gln Leu Asp Ser  
515 520 525

Asp Asp Tyr Leu Glu Pro Asp Ala Val Glu Leu Cys Leu Lys Glu Phe  
530 535 540

Leu Lys Asp Lys Thr Leu Ala Cys Val Tyr Thr Thr Asn Arg Asn Val  
545 550 555 560

Asn Pro Asp Gly Ser Leu Ile Ala Asn Gly Tyr Asn Trp Pro Glu Phe  
565 570 575

Ser Arg Glu Lys Leu Thr Thr Ala Met Ile Ala His His Phe Arg Met  
580 585 590

Phe Thr Ile Arg Ala Trp His Leu Thr Asp Gly Phe Asn Glu Lys Ile  
595 600 605

Glu Asn Ala Val Asp Tyr Asp Met Phe Leu Lys Leu Ser Glu Val Gly  
610 615 620

Lys Phe Lys His Leu Asn Lys Ile Cys Tyr Asn Arg Val Leu His Gly  
625 630 635 640

Sequence Listing created in PatentIn.ST25

Asp Asn Thr Ser Ile Lys Lys Leu Gly Ile Gln Lys Lys Asn His Phe  
645 650 655

Val Val Val Asn Gln Ser Leu Asn Arg Gln Gly Ile Thr Tyr Tyr Asn  
660 665 670

Tyr Asp Glu Phe Asp Asp Leu Asp Glu Ser Arg Lys Tyr Ile Phe Asn  
675 680 685

Lys Thr Ala Glu Tyr Gln Glu Glu Ile Asp Ile Leu Lys Asp Ile Lys  
690 695 700

Ile Ile Gln Asn Lys Asp Ala Lys Ile Ala Val Ser Ile Phe Tyr Pro  
705 710 715 720

Asn Thr Leu Asn Gly Leu Val Lys Lys Leu Asn Asn Ile Ile Glu Tyr  
725 730 735

Asn Lys Asn Ile Phe Val Ile Val Leu His Val Asp Lys Asn His Leu  
740 745 750

Thr Pro Asp Ile Lys Lys Glu Ile Leu Ala Phe Tyr His Lys His Gln  
755 760 765

Val Asn Ile Leu Leu Asn Asn Asp Ile Ser Tyr Tyr Thr Ser Asn Arg  
770 775 780

Leu Ile Lys Thr Glu Ala His Leu Ser Asn Ile Asn Lys Leu Ser Gln  
785 790 795 800

Leu Asn Leu Asn Cys Glu Tyr Ile Ile Phe Asp Asn His Asp Ser Leu  
805 810 815

Phe Val Lys Asn Asp Ser Tyr Ala Tyr Met Lys Lys Tyr Asp Val Gly  
820 825 830

Met Asn Phe Ser Ala Leu Thr His Asp Trp Ile Glu Lys Ile Asn Ala  
835 840 845

Sequence Listing created in PatentIn.ST25

His Pro Pro Phe Lys Lys Leu Ile Lys Thr Tyr Phe Asn Asp Asn Asp  
850 855 860

Leu Lys Ser Met Asn Val Lys Gly Ala Ser Gln Gly Met Phe Met Thr  
865 870 875 880

Tyr Ala Leu Ala His Glu Leu Leu Thr Ile Ile Lys Glu Val Ile Thr  
885 890 895

Ser Cys Gln Ser Ile Asp Ser Val Pro Glu Tyr Asn Thr Glu Asp Ile  
900 905 910

Trp Phe Gln Phe Ala Leu Leu Ile Leu Glu Lys Lys Thr Gly His Val  
915 920 925

Phe Asn Lys Thr Ser Thr Leu Thr Tyr Met Pro Trp Glu Arg Lys Leu  
930 935 940

Gln Trp Thr Asn Glu Gln Ile Glu Ser Ala Lys Arg Gly Glu Asn Ile  
945 950 955 960

Pro Val Asn Lys Phe Ile Ile Asn Ser Ile Thr Leu  
965 970

<210> 10  
<211> 568  
<212> PRT  
<213> Paramecium bursaria chorella virus

<400> 10

Met Gly Lys Asn Ile Ile Ile Met Val Ser Trp Tyr Thr Ile Ile Thr  
1 5 10 15

Ser Asn Leu Ile Ala Val Gly Gly Ala Ser Leu Ile Leu Ala Pro Ala  
20 25 30

Ile Thr Gly Tyr Val Leu His Trp Asn Ile Ala Leu Ser Thr Ile Trp  
35 40 45

Gly Val Ser Ala Tyr Gly Ile Phe Val Phe Gly Phe Phe Leu Ala Gln

Sequence Listing created in PatentIn.ST25

50            55            60  
Val Leu Phe Ser Glu Leu Asn Arg Lys Arg Leu Arg Lys Trp Ile Ser  
65            70            75            80  
  
Leu Arg Pro Lys Gly Trp Asn Asp Val Arg Leu Ala Val Ile Ile Ala  
85            90            95  
  
Gly Tyr Arg Glu Asp Pro Tyr Met Phe Gin Lys Cys Leu Glu Ser Val  
100            105            110  
  
Arg Asp Ser Asp Tyr Gly Asn Val Ala Arg Leu Ile Cys Val Ile Asp  
115            120            125  
  
Gly Asp Glu Asp Asp Asp Met Arg Met Ala Ala Val Tyr Lys Ala Ile  
130            135            140  
  
Tyr Asn Asp Asn Ile Lys Lys Pro Glu Phe Val Leu Cys Glu Ser Asp  
145            150            155            160  
  
Asp Lys Glu Gly Glu Arg Ile Asp Ser Asp Phe Ser Arg Asp Ile Cys  
165            170            175  
  
Val Leu Gin Pro His Arg Gly Lys Arg Glu Cys Leu Tyr Thr Gly Phe  
180            185            190  
  
Gin Leu Ala Lys Met Asp Pro Ser Val Asn Ala Val Val Leu Ile Asp  
195            200            205  
  
Ser Asp Thr Val Leu Glu Lys Asp Ala Ile Leu Glu Val Val Tyr Pro  
210            215            220  
  
Leu Ala Cys Asp Pro Glu Ile Gin Ala Val Ala Gly Glu Cys Lys Ile  
225            230            235            240  
  
Trp Asn Thr Asp Thr Leu Leu Ser Leu Leu Val Ala Trp Arg Tyr Tyr  
245            250            255  
  
Ser Ala Phe Cys Val Glu Arg Ser Ala Gin Ser Phe Phe Arg Thr Val

Sequence Listing created in PatentIn ST25

260 265 270

Gln Cys Val Gly Gly Pro Leu Gly Ala Tyr Lys Ile Asp Ile Ile Lys  
275 280 285

Glu Ile Lys Asp Pro Trp Ile Ser Gln Arg Phe Leu Gly Gln Lys Cys  
290 295 300

Thr Tyr Gly Asp Asp Arg Arg Leu Thr Asn Glu Ile Leu Met Arg Gly  
305 310 315 320

Lys Lys Val Val Phe Thr Pro Phe Ala Val Gly Trp Ser Asp Ser Pro  
325 330 335

Thr Asn Val Phe Arg Tyr Ile Val Gln Gln Thr Arg Trp Ser Lys Ser  
340 345 350

Trp Cys Arg Glu Ile Trp Tyr Thr Leu Phe Ala Ala Trp Lys His Gly  
355 360 365

Leu Ser Gly Ile Trp Leu Ala Phe Glu Cys Leu Tyr Gln Ile Thr Tyr  
370 375 380

Phe Phe Leu Val Ile Tyr Leu Phe Ser Arg Leu Ala Val Glu Ala Asp  
385 390 395 400

Pro Arg Ala Gln Thr Ala Thr Val Ile Val Ser Thr Thr Val Ala Leu  
405 410 415

Ile Lys Cys Gly Tyr Phe Ser Phe Arg Ala Lys Asp Ile Arg Ala Phe  
420 425 430

Tyr Phe Val Leu Tyr Thr Phe Val Tyr Phe Phe Cys Met Ile Pro Ala  
435 440 445

Arg Ile Thr Ala Met Met Thr Leu Trp Asp Ile Gly Trp Gly Thr Arg  
450 455 460

Gly Gly Asn Glu Lys Pro Ser Val Gly Thr Arg Val Ala Leu Trp Ala

Sequence Listing created in PatentIn.ST25

465

470

475

480

Lys Gln Tyr Leu Ile Ala Tyr Met Trp Trp Ala Ala Val Val Gly Ala  
485 490 495

Gly Val Tyr Ser Ile Val His Asn Trp Met Phe Asp Trp Asn Ser Leu  
500 505 510

Ser Tyr Arg Phe Ala Leu Val Gly Ile Cys Ser Tyr Ile Val Phe Ile  
515 520 525

Val Ile Val Leu Val Val Tyr Phe Thr Gly Lys Ile Thr Thr Trp Asn  
530 535 540

Phe Thr Lys Leu Gln Lys Glu Leu Ile Glu Asp Arg Val Leu Tyr Asp  
545 550 555 560

Ala Thr Thr Asn Ala Gln Ser Val  
565